

What Is Claimed Is:

1. A magnesium base alloy pipe, wherein said pipe is produced by drawing a pipe blank of a magnesium base alloy containing either of the following ingredients (1) or (2):

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

2. A magnesium base alloy pipe according to claim 1 above, wherein said pipe has a 3 % or higher elongation and 250 MPa or higher tensile strength above.

3. A magnesium base alloy pipe according to claim 2 above, wherein said tensile strength is 350 MPa or above.

4. A magnesium base alloy pipe according to claim 2 above, wherein said elongation is in the range of 15-20 % and said tensile strength is in the range of 250-350 MPa.

5. A magnesium base alloy pipe according to claim 2 above, wherein said elongation is 5 % or above and said tensile strength is 280 MPa or above.

6. A magnesium base alloy pipe according to claim 5 above, wherein said tensile strength is above 300 MPa.

7. A magnesium base alloy pipe according to claim 5 above, wherein said elongation is 5 % or above but below 12 %.

8. A magnesium base alloy pipe according to claim 5 above, wherein said elongation is 12 % or above.

9. A magnesium base alloy pipe, wherein said alloy contains either of the following ingredients (1) or (2) and said pipe has a 0.75 or greater YP ratio:

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

10. A magnesium base alloy pipe according to claim 9 above, wherein said YP ratio is 0.75 or above but below 0.90.

11. A magnesium base alloy pipe according to claim 9 above, wherein said YP ratio is 0.90 or above.

12. A magnesium base alloy pipe, wherein said alloy contains either of the following ingredients (1) or (2) and said pipe has a 0.2 % proof stress of 220 MPa or above:

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

13. A magnesium base alloy pipe according to claim 12 above, wherein said 0.2 % proof stress is 250 MPa or above.

14. A magnesium base alloy pipe, wherein said alloy contains either of the following ingredients (1) or (2) and said alloy has a 10 μm or smaller average grain size:

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

15. A magnesium base alloy pipe, wherein said alloy contains either of the following ingredients (1) or (2) and said alloy has a duplex grain structure comprising fine grains and coarse grains.

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

16. A magnesium base alloy pipe according to claim 15 above, wherein said alloy has a duplex grain structure comprising grains having a 3 μm or smaller average grain size and grains having a 15 μm or greater average grain size.

17. A magnesium base alloy pipe according to claim 16 above, wherein said grains having a 3 μm smaller average grain size have a 10 % or greater grains area share.

18. A magnesium base alloy pipe, wherein said alloy contains either of the following ingredients (1) or (2) and said alloy has a mixed structure comprising twins and recrystallized grains.

(1) about 0.1-12.0 mass % of Al; or

(2) about 1.0-10.0 mass % of Zn and about 0.1-2.0 mass % of Zr.

19. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe has a surface roughness R_z defined by $R_z \leq 5 \mu\text{m}$ on the surface thereof.

20. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe has a 80 MPa or smaller axial residual tensile stress in the surface thereof.

21. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe has a 0.02 mm or smaller differential outside diameter.

22. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe has a noncircular cross-sectional shape.

23. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said alloy comprises containing about 0.1-12.0 mass % of Al plus about 0.1-2.0 mass % of Mn.

24. A magnesium base alloy pipe according to claim 23 above, wherein said alloy comprises containing about 0.1-12.0 mass % of Al plus at least one

ingredient to be selected from the group consisting of about 0.1-5.0 mass % of Zn and about 0.1-5.0 mass % of Si.

25. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe have a 0.5 mm or smaller wall thickness.

26. A magnesium base alloy pipe according to any one of the preceding claim 1 through 18, wherein said pipe comprise a butted pipe having longitudinally a uniform outside diameter with its inside diameters at its opposite end portions being smaller than that of its intermediate portion.

27. A method of manufacturing a magnesium base alloy pipe comprising:
a step of providing a pipe blank of any one of the following magnesium base alloys (A) through (C):

(A) a magnesium base alloy containing about 0.1-12.0 mass % of Al;

(B) a magnesium base alloy containing about 0.1-12.0 mass % of Al plus at least one ingredient to be selected from the group consisting of about 0.1-2.0 mass % of Mn, 0.1-5.0 mass % of Zn and 0.1-5.0 mass % of Si; or

(C) a magnesium base alloy containing about 1.0-10.0 mass % of Zn and 0.1-2.0 mass % of Zr;

a metal pointing step for pointing said pipe blank; and

a drawing step for drawing the resultant pointed pipe blank;

wherein said drawing step is executed at a drawing temperature of 50 °C or above.

28. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein heating to said drawing temperature is accomplished by heating the pipe blank in an atmosphere furnace, heating the same in a high-frequency heating furnace, or heating a drawing die.

29. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing temperature ranges from 100 °C to 350 °C.

30. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein area reduction ratio in one drawing pass is 5 % or above.

31. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing step is accomplished in a multistep process using plurality of dies.

32. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing step is accomplished by using at least a die, heating only an initial working portion of a pointed pipe blank where it contacts said die, and drawing said pointed pipe blank at the temperature of the thus heated initial working portion or as it cools naturally therefrom.

33. A method of manufacturing a magnesium base alloy pipe according to claim 32 above, wherein a heating temperature of said initial working portion ranges of 150 °C or more but below 400 °C.

34. A method of manufacturing a magnesium base alloy pipe comprising:
a step of providing a pipe blank of any one of the following magnesium base alloys (A) through (C):

(A) a magnesium base alloy containing about 0.1-12.0 mass % of Al;

(B) a magnesium base alloy containing about 0.1-12.0 mass % of Al plus at least one ingredient to be selected from the group consisting of about 0.1-2.0 mass % of Mn, 0.1-5.0 mass % of Zn and 0.1-5.0 mass % of Si; or

(C) a magnesium base alloy containing about 1.0-10.0 mass % of Zn and 0.1-2.0 mass % of Zr;

a metal pointing step for pointing said pipe blank; and

a drawing step for drawing the resultant pointed pipe blank;

wherein said pointing step is accomplished by heating at least a front working end of the pipe blank entering a pointing machine.

35. A method of manufacturing a magnesium base alloy pipe according to claim 34 above, wherein said front working end is heated at its portion contacting said pointing machine.

36. A method of manufacturing a magnesium base alloy pipe according to claim 34 above, wherein said pointing step is executed by controlling at least the temperature of said front working end entering said pointing machine to 50-450 °C.

37. A method of manufacturing a magnesium base alloy pipe according to claim 34 above, wherein said pointing step is executed with a heat insulating material inserted in the front end of the pipe blank.

38. A method of manufacturing a magnesium base alloy pipe according to claim 34 above, wherein said pointing step is executed on a swaging machine by heating the front end of the pipe blank in a heated liquid.

39. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, further comprising a lubrication step for lubricating at least an initial working portion of the pipe blank in advance of said drawing step.

40. A method of manufacturing a magnesium base alloy pipe according to claim 39 above, wherein said lubrication step comprises immersing the pipe blank in a preheated lubricant.

41. A method of manufacturing a magnesium base alloy pipe according to claim 39 above, wherein said lubrication step forms a lubricant coating on the pipe blank.

42. A method of manufacturing a magnesium base alloy pipe according to claim 41 above, wherein said lubricant coating comprises a fluorine-based resin.

43. A method of manufacturing a magnesium base alloy pipe according to claim 42 above, wherein said fluorine-based resin comprises a PTFE or PFA.

44. A method of manufacturing a magnesium base alloy pipe according to claim 41 above, wherein said lubricant coating is formed by dispersing a fluorine-based resin in water to prepare an aqueous dispersion thereof, immersing the pipe blank in said aqueous dispersion, and heating the pipe blank taken out of said aqueous dispersion.

45. A method of manufacturing a magnesium base alloy pipe according to claim 44 above, wherein the pipe blank taken out of said aqueous dispersion at about 300-450 °C.

46. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing step comprises mandrel drawing using a mandrel passing through a die and a lubricant coating is formed on said mandrel.

47. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing step comprises:

a first plain drawing step in which one end of the pipe blank is passed through a die inside and the pipe blank is drawn without squeezing its wall between the inside of the die and a plug;

a plug drawing step for squeezing an intermediate portion of the pipe blank between the inside of the die and the plug; and

a second plain drawing step in which the other end of the pipe blank is drawn without squeezing its wall between the inside of the die and the plug;

to form a butted pipe having thick-walled opposite ends and a thin-walled intermediate portion.

48. method of manufacturing a magnesium base alloy pipe according to claim 27 above, wherein said drawing step comprises mandrel drawing using a mandrel having longitudinally varied outside diameters to form a butted pipe.

49. A method of manufacturing a magnesium base alloy pipe according to claim 48 above, wherein the pipe blank is drawn by grasping its front working end extending out of a die exit.

50. A method of manufacturing a magnesium base alloy pipe according to claim 48 above, wherein said drawing step is executed in multiple passes by using dies having varied inside diameters.

51. A method of manufacturing a magnesium base alloy pipe according to claim 27 above, further comprising a heat treatment step for heating a drawn pipe at

150 °C or higher temperatures.

52. A method of manufacturing a magnesium base alloy pipe according to claim 51 above, wherein said heat treatment step is executed at 300 °C or lower temperatures.